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(71) Applicant: **NIVOBA ENGINEERING B.V.**
No. 1, Industrieweg
NL-9641 HM Veendam(NL)

(72) Inventor: **Holthuis, Herman**
No. 42, Marktstraat
NL-9641 EL Veendam(NL)

(74) Representative: **'t Jong, Bastiaan Jacobus et al**
OCTROOIBUREAU ARNOLD & SIEDSMA
Sweelinckplein 1
NL-2517 GK 's-Gravenhage(NL)

(54) Method and device for obtaining starch and vegetable water from root crops.

(57) Method for obtaining starch and vegetable water from root crops, comprising of grinding or shredding the crops and separating the starch and vegetable water thereby released. Separation takes place in at least three separation stages, namely a first stage to which the ground crops are supplied and fibers and vegetable water are discharged on the one hand and a suspension of starch in substantially vegetable water on the other, a second stage to which are fed the suspension separated in the first stage and a portion of the discharge washing liquid from a third stage, to which third stage are further added a starch suspension coming from the second stage and clean water and wherein the second stage is a displacement stage in which the vegetable water in the added suspension is substantially displaced by discharge washing liquid from the third stage.

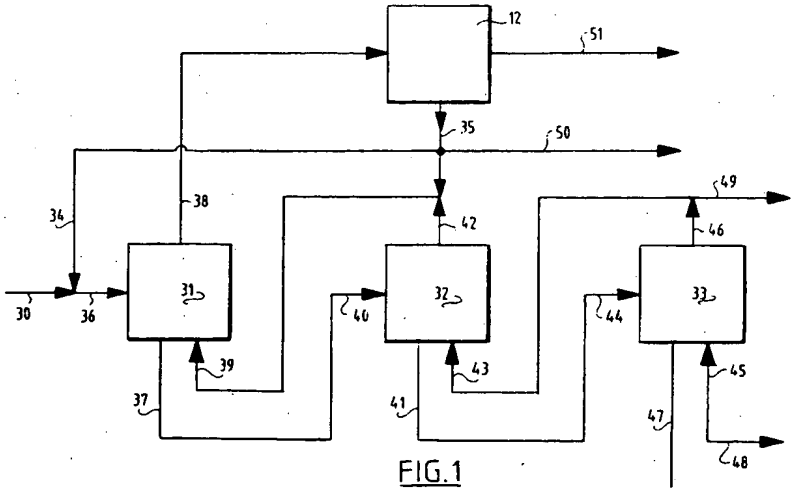

FIG.1

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value.

The feed pump is preferably a displacer pump. The constant material supply is hereby achieved in simple manner.

When the step of claim 10 is applied, it is achieved in favourable manner that the whole system is closed and remains free of air, whereby the separated vegetable water is likewise practically free of air and no problems can occur with respect to foam formation. Grinding of the raw material under vacuum is per se known from the European patent application 83 104185.

The invention will be further elucidated in the following description with reference to the embodiment shown in the figures.

Fig. 1 shows schematically the different phases and material flows.

Fig. 2 shows schematically an embodiment of the device according to the invention.

The same reference numerals are used in fig. 1 and 2 to designate corresponding components.

The first stage in the method for obtaining starch and vegetable water from root crops is for instance grinding the root crops, wherein at least 80% of the fibers in the ground material have a particle size of smaller than 0.4 mm. This ground material is fed in at 30, as seen in fig. 1. A suspension of starch in clean water obtained from the root crops is discharged at 48. The fibers still having a small quantity of starch and vegetable water are discharged at 51. Clean water is supplied at 47 and slightly contaminated waste liquid is indicated at 49.

The above specified separation takes place in substantially three separation stages 31, 32 and 33. At the first stage the ground material 30 is fed in at 36 together with a quantity of diluting liquid 34 formed by extracted vegetable water. Supplied at 39 to the first stage is washing liquid consisting of the washing liquid discharge 42 from the second stage 32, which is yet to be described, and vegetable water. At the washing agent discharge 38 the fibres and the vegetable water are discharged from the first stage. This mixture is fed to a decanter centrifuge 12 from which de-watered fibers 51 still having a small quantity of starch are released on one side and vegetable water on the other side at 35. Via the suspension outlet 37 of the first stage 31 a suspension of starch in vegetable water is discharged from the first stage 31.

This starch suspension is carried via the feed 40 into the second stage 32. Further supplied hereto at the washing liquid feed 43 is washing liquid consisting of washing liquid discharged from the third stage 33 at 46.

The second stage 32 is a displacement stage in which the vegetable water in the starch suspension fed in at 40 is substantially displaced by the discharge washing liquid of the third stage 33 fed in at 43. Discharged at 42 from the second stage 32 is liquid consisting of slightly diluted vegetable water. As noted earlier, this liquid, supplemented with vegetable water 35 from the de-watering installation 12, is fed as washing liquid to the first stage 31.

The starch suspension leaving the second stage 32 at 41 now contains only a small amount of dissolved constiuents. This suspension is fed to the third stage 33 at 44 where it is further cleaned. As noted, clean water is supplied at 47 to this third stage as washing liquid. At the suspension outlet 45 the supplied starch leaves the device suspended in clean water. The suspension liquid of the suspension fed in at 44 leaves the third stage 33 together with the excess washing liquid at the washing liquid discharge 46. This only slightly contaminated liquid is used as washing liquid in the second stage 32. Only the smallest possible amount hereof necessary for the good functioning of the second stage 32 is used. The excess of slightly contaminated liquid is discharged at 49 and can still be usefully employed for instance in washing the root crops before they are ground.

In one embodiment of the device, the first stage, which has fiber separation as its most important function, can comprise a sieving device. The second stage 32, in which the vegetable water in the supplied suspension is displaced, may comprise a filter device. The third stage 33, in which the starch is washed, may comprise separators and/or decanters. The de-watering in the device 12 can also be performed in different ways. For instance through sieving followed by compression, or using the above mentioned decanter centrifuge.

According to a preferred embodiment as shown in fig. 2, the three separation stages are formed by multi-hydrocyclone systems connected in cascade. The de-watering device 12 is a closed decanter centrifuge in this preferred embodiment. The grinding device (not further shown) is herein of the type that can grind the crops under pressure. The thus obtained preferred device is entirely closed and can therefore remain free of air, whereby eventual problems of foam formation are avoided.

In the preferred embodiment of fig. 2 the feed pumps of the multi-hydrocyclones are centrifugal pumps driven at a fixed speed of rotation. This is possible because all material flows in the system are fixed. This is achieved in that the feed pump 1 is a displacer pump and thus generates a constant rate of flow into the feed 36 for the first stage 31. A flow control valve 56 is further accommodated in the connecting conduit to

multi-hydrocyclone	17	0.976
multi-hydrocyclone	18	0.976
multi-hydrocyclone	19	1.2

It is noted that the ratios given here are based on the liquid flows with solid material. Calculated for liquid flows without the solids the ratios amount respectively to

multi-hydrocyclone	13	4.4
multi-hydrocyclone	14	5.84
multi-hydrocyclone	15	1.14
multi-hydrocyclone	16	1.32
multi-hydrocyclone	17	1.32
multi-hydrocyclone	18	1.32
multi-hydrocyclone	19	1.52

The washing effect of the second stage is then 8.8.

Via the liquid feed 43 is added 27 m^3 of liquid from the liquid discharge 46 of the third stage. This liquid is slightly contaminated. The starch suspension from the suspension outlet 41 has a starch concentration of approximately 470 g/l and is only lightly contaminated. This suspension is supplied to the feed 44 of the third stage.

The ratio of the overflow and drain fractions of the multi-hydrocyclones in the third stage is:

multi-hydrocyclone	20	4
multi-hydrocyclone	21	4
multi-hydrocyclone	22	1.38
multi-hydrocyclone	23	1.18
multi-hydrocyclone	24	1.18
multi-hydrocyclone	25	1.18
multi-hydrocyclone	26	1.18
multi-hydrocyclone	27	1.18
multi-hydrocyclone	28	1.7

At 47 is added 42.7 m^3 of clean washing water. The clean starch suspension leaves the drain 45 with a concentration of approximately 470 g/l. The protein content in this suspension is less than 0.05% on dry substance basis.

Of the washing liquid discharge 46 which amounts in total to 42.7 m^3, 27 m^3 is, as noted, used as washing liquid for the second stage. The remaining portion of 15.7 m^3 is excess liquid containing 1.4% of the dissolved substances in the potato.

In the embodiment described here 98.6% of the vegetable water is obtained at a dilution of only 5%. The waste water flow contains only 1.4% of the vegetable water. The water consumption is comparatively very small and amounts to only 427 litres per 1000 kg of potatoes.

Claims

1. Method for obtaining starch and vegetable water from root crops, comprising of grinding or shredding the crops and separating the starch and vegetable water thereby released, wherein separation takes place in at least three separation stages, namely a first stage to which the ground crops are supplied

centrifuge of closed type and the grinding device is of a type which can grind the crops under vacuum.

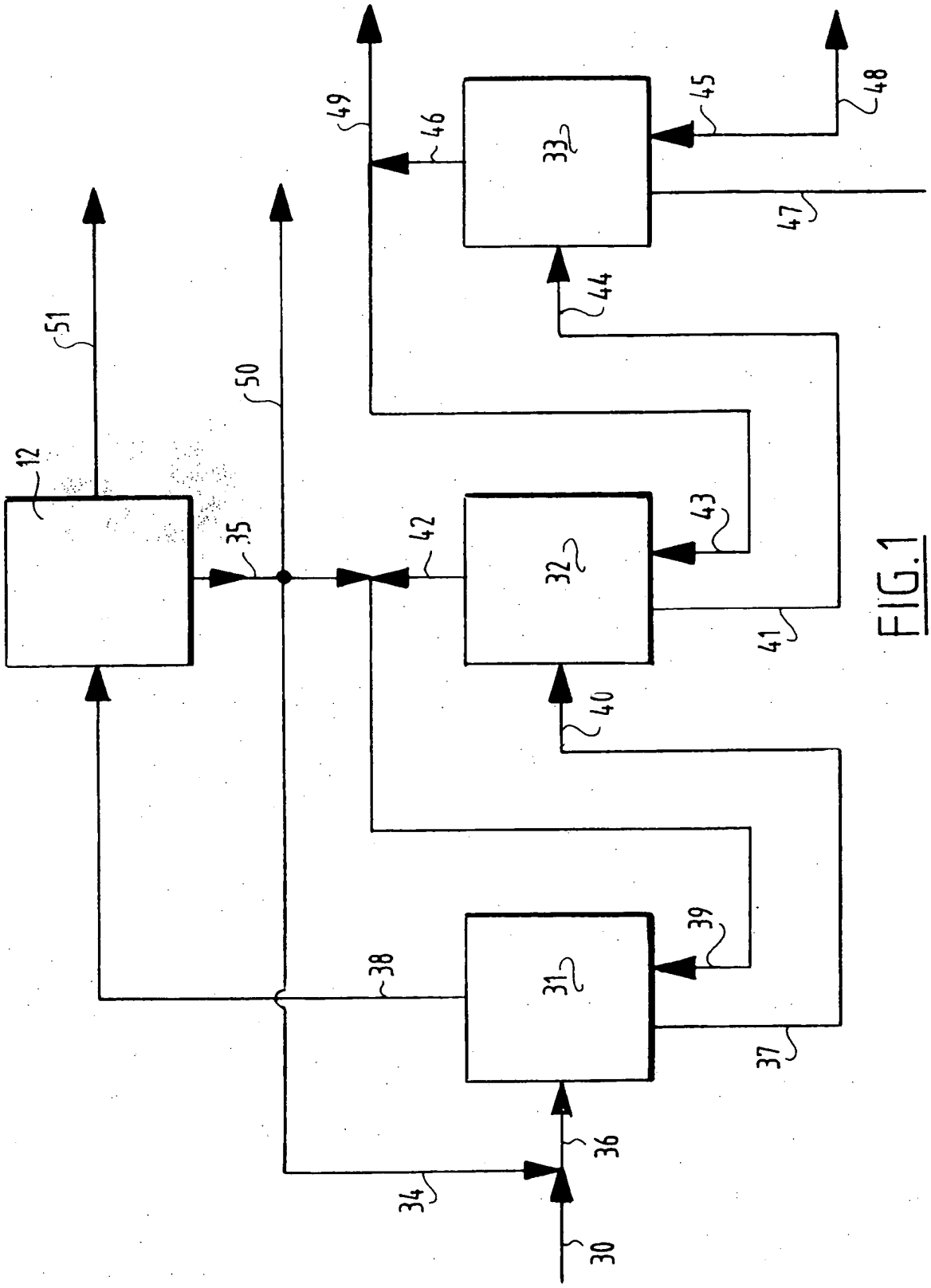

FIG.1

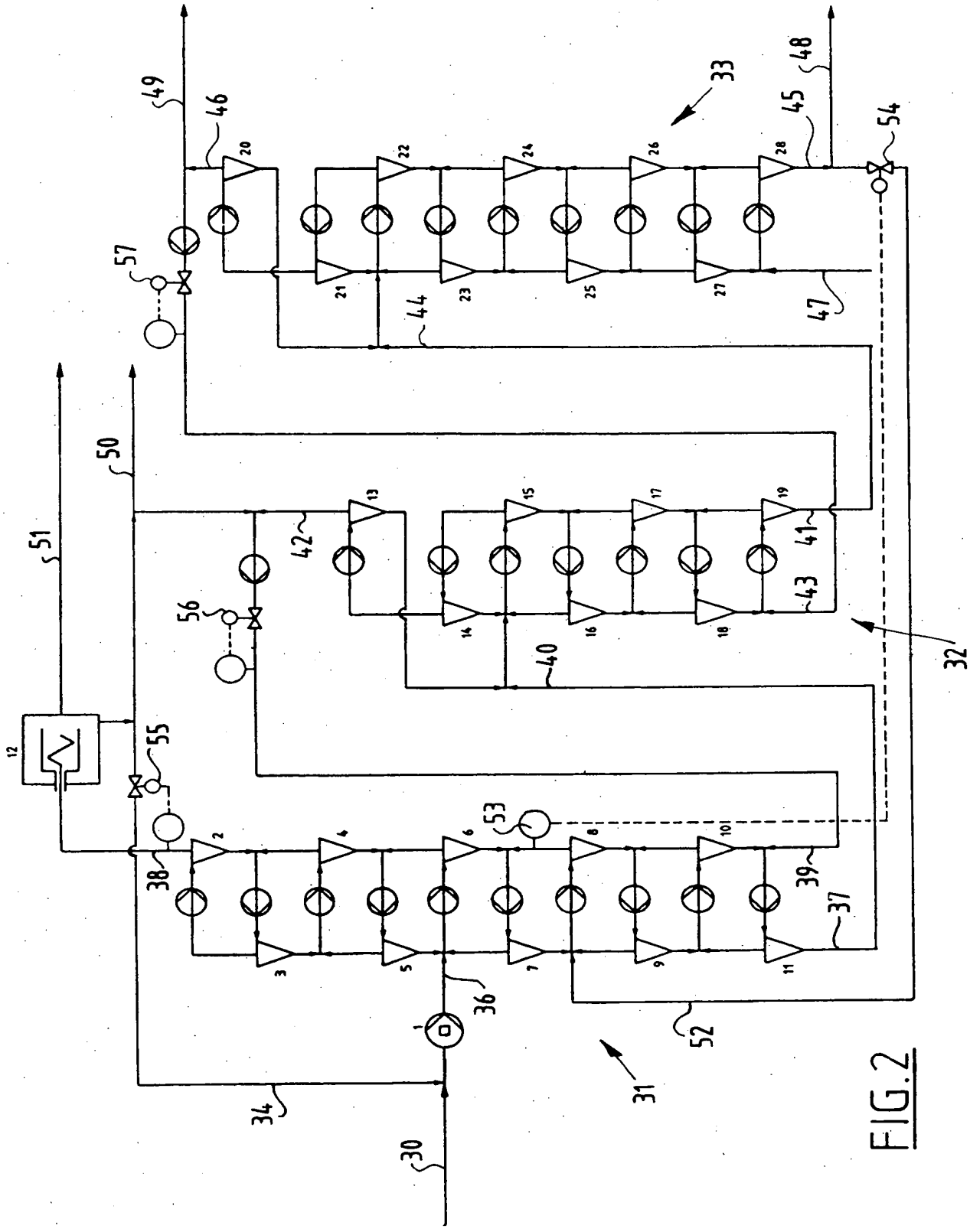
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FIG.2